



Intel-Based Electronic Classroom

Implementation Guide

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1.0 Document Objective

This document is intended to help System Integrators (SI) in setting up an Intel-based Electronic Classroom that focuses on diskless station remote boot setup. The remote boot solution is provided by the Qualystem LiteNET* PC for Intel-based Electronic Classroom software and Intel Electronic Classroom Remote Boot Utility. This document assumes that you are familiar with Microsoft* Windows* Networking and know how to:

- Add users to Windows* NT Server 4.0.
- Create network shares.
- Set permissions on shares.
- Set permissions on files on the server.
- Install Windows* 98 on the local hard disk of a computer.
- Install and set up Microsoft* Client for Windows* Networks on a Windows* 9x workstation.

1.1 Recommended System Requirements

1.1.1 Server Configuration

- Intel® Pentium® III processor at 600 MHz or above.
- Intel® 440BX or Intel® 440GX AGPSet system.
- Microsoft* Windows* NT 4.0 server with Service Pack 4 or higher installed.
- SCSI hard disk or 7200 rpm IDE drive with at least 33 MHz bus ultra DMA transfer.
- Internet Explorer 4.0 or higher.
- TCP/IP protocol.
- IPX/SPX compatible protocol.
- Microsoft* NT DHCP service.
- Intel Electronic Classroom Remote Boot Utility.
- Network adapter (100 Mbs Fast Ethernet recommended).

1.1.2 Teacher Station Configuration

- Intel® Pentium® III processor at 500 MHz or above.
- Intel® 440BX AGPSet, Intel® 810E or Intel® 810 Chipset multimedia system.
- Support Windows* 98.
- TCP/IP protocol.
- Full duplex sound card with full Direct Sound support.
- CD-ROM drive and harddisk drive.
- 10/100 Mbps network card.
- Multimedia teaching software.
- Capture card (optional).
- USB camera (optional).
- Microscope (optional).

1.1.3 Student Computing Station Configuration

- Intel® Pentium® III processor or Intel® Celeron™ processor at 433 MHz or above.
- A motherboard recommend from the Third Party Board Vendor (TPBV).
- Please contact local Intel sales office.
- TCP/IP protocol.
- IPX/SPX compatible protocol.
- PXE code integrated in BIOS.
- Microsoft® Windows® 98 OEM installation CD.
- CD-ROM drive and hard-disk drive for initial configuration.
- Floppy drive.
- Full duplex sound card with full Direct Sound support.

1.2 Installation Overview

The following processes are needed to install the remote boot solution:

- Server
 - Install Windows® NT 4.0 server and DHCP Server.
 - Install Intel Electronic Classroom Remote Boot Utility.
 - Configure DHCP, ProxyDHCP and Boot Server.
 - Create Remote Boot Image.
- Student Computing Station
 - Install Windows® 98.
 - Configure TCP/IP, IPX/SPX Compatible and NetBEUI protocol.
 - Install all necessary software including Multimedia Teaching Software.
 - Install the LiteNET® PC software on the station.
 - Remove hard disk from student computing station.

2.0 Remote Boot Implementation (Server)

2.1 Setting Up the NT Server

Windows* NT server must support Microsoft* DHCP, PXE, and MTFTP services. Below are the necessary components:

- Install Windows* NT server (4.0, SP4 or later) on server. Ensure C: and D: drives are of NTFS format.
- Install the correct NIC driver at the beginning of installation.
- Set Windows* NT server as Primary Domain Controller.
- Install TCP/IP and assign a static IP address to the server.
- Install IPX/SPX-compatible protocol, NetBEUI protocol and Microsoft* DHCP server.
- Add appropriate users by using User Manager.

2.2 Setting Up the DHCP Service

Windows* NT server provides the DHCP service. The following section describes how to setup the DHCP service for IP address assignment.

2.2.1 Installing the Microsoft* DHCP Server

1. Go to the NT server Control Panel (Start->Settings->Control Panel.)
2. Double-click the 'Network' icon. (The 'Network' dialog box appears.)
 - a. Choose the 'Services' tab, and choose the 'Add' button. (The 'Select Network Service' dialog box appears.)
3. Select 'Microsoft* DHCP Server' from the 'Network Service' list box, and choose 'OK'. (The Windows* NT Setup dialog box appears, prompting the user to enter the path to the source files needed to copy in order to install the DHCP server service.)
4. Enter the path to the location of the Setup files on the Windows* NT 4.0 Server CD-ROM, and choose the 'Continue' button. (The 'Setup' program copies the required files, and a warning appears, stating that all network adapters in the computer must be configured with fixed IP addresses.)

Note: The Setup files are typically located at 'x:\i386', where 'x' is the drive letter of the CD-ROM.

5. Choose 'OK'. 'Microsoft* DHCP Server' appears in 'Network Service' list box.
6. Close 'Network' dialog box. (Windows* NT Server 4.0 updates network bindings, and a dialog box appears prompting the user to restart the computer in order to enable the new settings.)

Note: If TCP/IP was configured using DHCP-assigned addresses, the 'Microsoft* TCP/IP Properties' dialog box appears, and fixed IP addresses must be manually configured for each network adapter on the server.

7. Choose 'Yes' to restart the computer, and enable the new settings.

2.2.2 Creating a New Scope for DHCP Server

1. Click 'Start' on the Windows* task bar and select the 'Programs' menu.
2. Select 'Administrative Tools (Common)' and 'DHCP Manager'. Select the server for which a DHCP scope is to be created, in the 'DHCP Servers' list box.
3. Select the 'Scope' menu and select 'Create'. (The 'Create Scope' dialog box appears.)
4. In the 'Start Address' and 'End Address' boxes, type the beginning and ending IP addresses for the available range of addresses defined by this scope.

Note: DHCP Manager automatically enters a proposed subnet mask value in the 'Subnet Mask' box, based on the values entered in the 'Start Address' and 'End Address' boxes. Accept the proposed value unless a different value is required.

5. Select the 'Limited To' radio button, and enter the appropriate values in the 'Days(s)', 'Hours(s)', and 'Minutes' text boxes.
6. If you do not want IP addresses in the scope to expire, select the 'Unlimited' radio button.
7. Type a name for the scope in the 'Name' box.
8. Click 'OK'. (A message appears stating that the scope has not been activated, with an option to activate the scope immediately.)

Note: Do not activate a new DHCP scope until the DHCP Option for the scope has been configured. To complete this procedure, click 'No', and select the 'DHCP Options' menu in the 'DHCP Manager' window.

2.2.3 Defining Option 60

Note: You must define option 60 to the DHCP service as a string, and then define the value of the data portion of the option. The DHCP service attaches the option number (0x3C) and the data length (0x09). If PXE Service in proxy DHCP mode are running on the same host server as the DHCP service, you must add the DHCP Class Identifier option (tag value 60) to the DHCP service. Do not add this tag to the DHCP service if PXE service is not installed on the DHCP server. This option must be set to "PXEClient". The purpose of adding option tag 60 to the DHCP service is to inform the client that PXE services are available on the same host as the DHCP service. When a PXE Client receives option 60 by itself from the DHCP service, the client immediately unicasts a request to proxy DHCP on port 4011 to complete the PXE DHCP configuration.

1. Start the DHCP Manager by Start->Programs->AdministrativeTools (Common)->DHCP Manager.
2. In the panel labeled DHCP Servers, double-click Local Machine to display the DHCP scopes you have previously defined.
3. Single-click on any one of the scopes to highlight it.
4. With a scope highlighted, click on the menu DHCP Options->Default.
5. Select the New... button to display the Add Option Type dialog box.
6. Enter the text Class ID in the Name field.
7. Make sure the Data Type is set to String and that the Array checkbox is not set.
8. In the Identifier field enter 60.
9. Click OK. The dialog box titled DHCP Options: Default Values should be displayed.

10. Click the drop-down arrow on the Option Name drop-down list.
11. Scroll to the entry for option 060 and click it. The drop-down list should close and the Option Name box displays the text 060 Class ID.
12. Enter the following string into the new field of Value Dialog Box: PXEClient.
13. Review the values displayed in the Value group using the scroll bar to move up and down in the list. If corrections are needed, select the Edit Array button and make the corrections needed.
14. Click OK to return to the DHCP Manager.

Note: It is normal to have “No Data is available” message prompted out

2.2.4 Assigning Option 60 to the Scopes

Assign option 60 to one or more scopes. The easiest way to do this is to assign the option globally.

1. With one of the scopes highlighted select the menu DHCP Options->Global to display the DHCP Options: Global dialog box.
2. Scroll the ‘Unused Options’ list to locate the option ‘060 Class ID’. Highlight the option and then click the Add-> button to add the option to the list of Active Options.
3. Click OK.

Note: Depending on the configuration of your routers, you may have to define a value for the router option tag. This ensures that the station receives a default gateway IP address

3.0 Installing the Intel Electronic Classroom Remote Boot Utility

3.1 Intel Electronic Classroom Remote Boot Utility Version 1.0

1. Run ECRBUtility.EXE
2. When the installation completes, continue with the installation of security file.

Note: One example for security filename applied under demo purpose is 00DD11111111.exe, following the MAC address provided. For production version, the filename is available under this format, for example 9C0CAG100000001.exe

3. The install program installs services and sets up associated registry keys with default values.
4. Reboot the system to start the new services.

3.2 Intel Electronic Classroom Remote Boot Utility Version 1.1

1. Run ECRBUtility.EXE and enter the password if the password request window prompt shows.
2. When the installation completes, extract zipped security files to the directory to which Intel Electronic Classroom Remote Boot Utility has been installed.
(e.g., if the default destination directory, which is C:\Program Files\Intel\ECRB, is used during the installation of Intel Electronic Classroom Remote Boot Utility, zipped security files should be extracted to C:\Program Files\Intel\ECRB. If another destination directory is selected to install Intel Electronic Classroom Remote Boot Utility, for example C:\Remoteboot, zipped security files should be extracted to C:\Remoteboot)

Note: One example of zipped name for security files applied under demo purpose is 00DD11111111.zip, following the MAC address provided. For production version, the filename is available under this format, for example 9C0CAG100000001.zip. Zipped security files contain three files, which are ECRBService.exe, ECRB.exe and Setup.bat.

3. Run Setup.bat under DOS Prompt.
4. Reboot the system to start the new services (ECRB Services and Intel PXE MTFTP Services).

Note: Intel Electronic Classroom Remote Boot Utility Window needs to be launched at server during the installation of LiteNET* PC. Intel ECRB Version 1.1 only validated working with LiteNET* PC Revision 1.14. Security file for Intel ECRB Version 1.1 possesses smaller file size compared with security file for Intel ECRB Version 1.0.

4.0 Installing Windows* 98 for Student Computing Stations

1. Install Windows* 98 to the station harddisk.
2. Configure the entire hardware configuration with all drivers installed including NIC, audio, etc.
3. Install all the applications needed, including Multimedia Interactive Learning Software.
4. Install IPX/SPX and NetBEUI protocol (Go to Control Panel -> Network -> Add -> Select Network Component Type -> Select Network Protocol).
5. Click File and Print Sharing button under Control Panel -> Network -> Configuration and check all the boxes to enable file and print sharing options.
6. Configure client for Microsoft* Networks Properties.
7. Go to Network Properties and double-click on "Clients for Microsoft* Networks". Ensure "Log on to Window NT domain" is checked and domain name is typed. Select "Logon and restore Network connections" instead of quick logon under Network Logon Options.
8. Go to Network Properties and ensure Microsoft* Family Logon is not located inside from Network Configuration List. If Microsoft* Family Logon exists, remove it from the list.
9. Go to "Password" under Control Panel and select "User Profiles" tab. Select second option to enable different users customizing different settings.
10. If automatic logon into Windows* feature during Student Computing Station boot-up process is required, install TWEAKUI by right clicking Tweakui.inf before setting up with LiteNET* PC. After the installation, check Control Panel to ensure TWEAKUI icon exists.

Note: TWEAKUI is available inside Windows* 98 Installation CD. Four files are required for TWEAKUI installation: Tweakui.cnt, Tweakui.cpl, Tweakui.hlp and Tweakui.inf. All files are located under Tools\Reskit\Powertoy folder. TWEAKUI can also be downloaded from http://www.Microsoft*.com/NTWorkstation/downloads/PowerToys/Networking/NTTweakUI.asp

11. Check if there is any drivers conflict under System Properties to ensure no conflict happens.
12. For Windows* 98 Simplified Chinese Version, replace Net.exe under Windows* directory with the same file provided for Intel-based Electronic Classroom setup.
13. Reboot the system and go to the DOS prompt directly before booting into Windows* (Press F8 after BIOS test.)
14. Type the following command to test the network:
c:\> Net start IPX
c:\> Net start workstation
c: \> Net view
15. If it is successful, then you can proceed to next section. If not, check your network NDIS5 driver.

Note: After set up with LiteNET* PC, the Windows* registry can not be modified again.

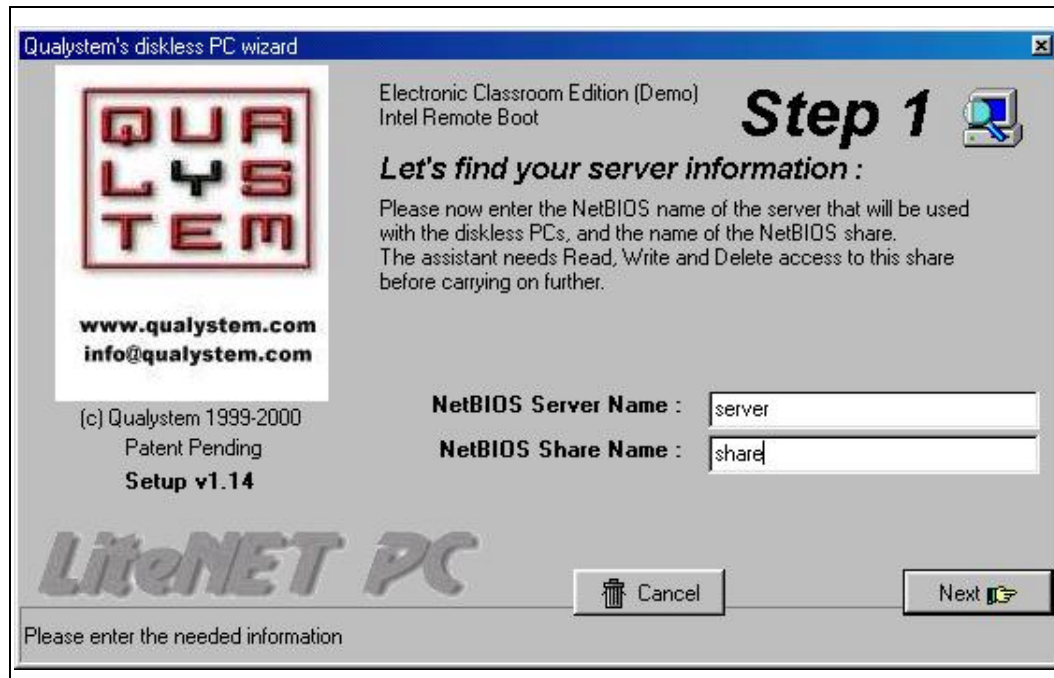
5.0 Install LiteNET* PC EZ Installer for Student Computing Stations

1. If LiteNET* PC Revision 1.14 and above is used, provide Administrator right to Group Memberships of that user, under User Manager for Domains, and launch Intel Electronic Classroom Remote Boot Utility Window at server before starting LiteNET* PC installation.

Note: The LiteNET* PC installation is not continued if ECRB Utility window is not launched. After LiteNET* PC installation, remove Administrator right from that user.

2. Create a shared folder inside the server for LiteNET* PC to copy student computing station harddisk contents over. Share the folder out.
3. Ensure there is enough server harddisk free space to accommodate student computing station harddisk contents.
4. Click Setup.exe located under LiteNET* PC EZ Installer directory to install LiteNET* PC.
5. At Step 1, enter NetBIOS Server Name and NetBIOS Share Name. An example is shown in Figure 1:

Figure 1. NetBIOS Server and Share Names

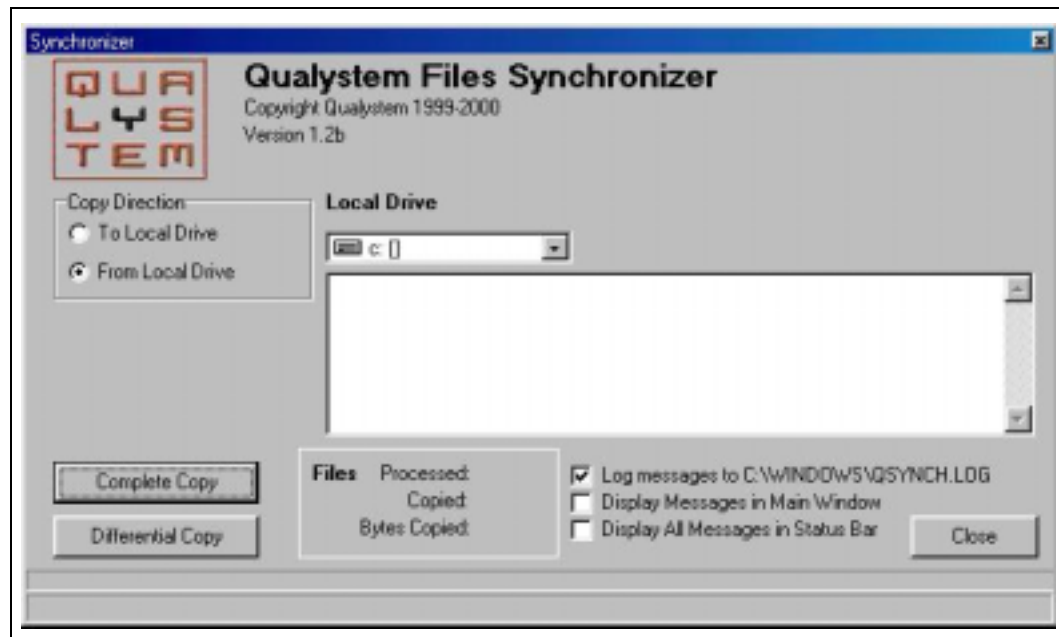


Note: NetBIOS Server Name refers to the name of Intel-based Electronic Classroom server and NetBIOS Share Name refers to the name of shared folder.

6. Follow installation steps from Step 2 until Step 5, when LiteNET* PC reboots the station and continues onto the second phase of the setup.
7. At Step 6, LiteNET* PC prompts for a floppy diskette. Insert a floppy diskette, format the diskette accordingly and continue with installation steps.

8. At Step 9, LiteNET* PC launches Qualystem File Synchronizer Utility (Figure 2). Click the 'Complete Copy' button to initiate whole content copy process, from student computing station to server.

Figure 2. File Synchronizer Utility



9. Continue installation steps until finished.

Note: If Student Computing Station uses Windows* 98 Second Edition, a message prompting for Ftuner.exe installation appears. If Ftuner Utility is not executed automatically, run Ftuner.exe, located under LiteNET* PC EZ Installer directory and follow the steps through.

Note: Please refer to documentation from Qualystem (litenet.pdf, section 'LiteNET* PC Installation') for more details on installing the LiteNET* PC software.

After installing the LiteNET* PC:

10. If LiteNET* PC Revision 1.14 and above is used, go to User Manager for Domains and ensure Administrator right has been removed from Group Memberships of the student.
11. Create a temporary NT user account named LNGUEST with the password LNGUEST.
12. Ensure the "emm386.exe" command line in config.sys of the LiteNET* boot disk (a:\config.sys) is remarked as indicated below (e.g., REM device=a:\emm386.exe noems command line)
13. Remove the command "/A" from the command line in the startnet.bat file. (a:\winboot\startnet.bat)
lh a:\winboot\qualreg %HOME%
14. To enable station virtual memory, go to the shared Windows* directory for the stations:
 - a. Edit usercmd.bat and remove the "REM" in front of the QVMEM.exe command line.
 - b. Add the following line in the [386Enh] section of the system.ini file:
PagingDrive=S:
MinPagingFileSize=65536
MaxPagingFileSize=65536

Note: You can modify the size of the swap file in the multiple of 32 MB.

15. Create a NetNames.db files in share Windows* directory using any editor like notepad.exe.

Here is an example of a NetNames.DB file:

```
#NetNames.DB sample

#Computer Name 00E04C390014 (MAC address)

Student1 00E04C390014

Student2 0048543D94ED
```

Note: The first field is the computer name and the second field is a network controller hardware address. Every space or tab at the beginning or at the end of a line is ignored. Every line that begins with a # is treated as a comment.

16. On the server, create NT user account names for all students located inside NetNames.DB file. Password must be the same as the user name. Ensure “User Cannot Change Password” and “Password Never Expires” are checked/enabled. The rest of the options, “Account disabled” and “User Must Change Password at Next Logon” are unchecked/disabled.

17. On the server, at Windows* shared directory:

- a. Backup the Windows* directory, including every file/subdirectory within the folder into another directory. The backup directory name can be defined according to user preference.

Note: The backup is to avoid re-installation of LiteNET* PC if Windows* files are corrupted. The user needs to recopy those files from backup directory to Windows* directory.

- b. Protect the Windows* directory (and every files/subdirectories within the folder) with “read only” for all users and “full control” for administrators.
- c. Create all student directories with the names the same as the Computer Names stated inside NetNames.DB.

Here is an example with the content of Netnames.DB stated as below:

```
#NetNames.DB sample

#Computer Name 00E04C390014 (MAC address)

Student1 00E04C390014

Student2 0048543D94ED
```

The names of directories created must be Student1 and Student2 by referring to Netnames.DB example stated above.

- d. Protect student directories (and every file/subdirectory within folder) with “full control” for that student, teacher, and administrator. Remove “full control” status for “everybody”.

Note: This prevents:

1. Accidental erasing of student directory contents due to system changes.
2. Accidental change of system settings (e.g., losing mouse driver) due to student login.
3. Student deletion of other student directory contents.

6.0 Remove Hard Disk from Student Computing Station

After you have finished configuring the LiteNET* PC for Intel-based Electronic Classroom software, shutdown the station and remove harddisk drive from the station. Boot up the station using the LiteNET* bootable diskette to ensure the remote boot is working. If everything is working fine,. enable the "Network Boot" feature in the BIOS before proceeding to the next section. Please refer to the user documentation for the motherboard used.

7.0 Making an Image File from LiteNET* PC Bootable Disk Using Intel Electronic Classroom Remote Boot Utility

- Create ECRB.1 boot file from the LiteNET* boot disk (these file is not provided by the Intel Electronic Classroom Remote Boot Utility installation from [Section 3.0](#)).
- Assume Intel Electronic Classroom Remote Boot Utility is installed in C:\Program Files\Intel\ECRB directory.

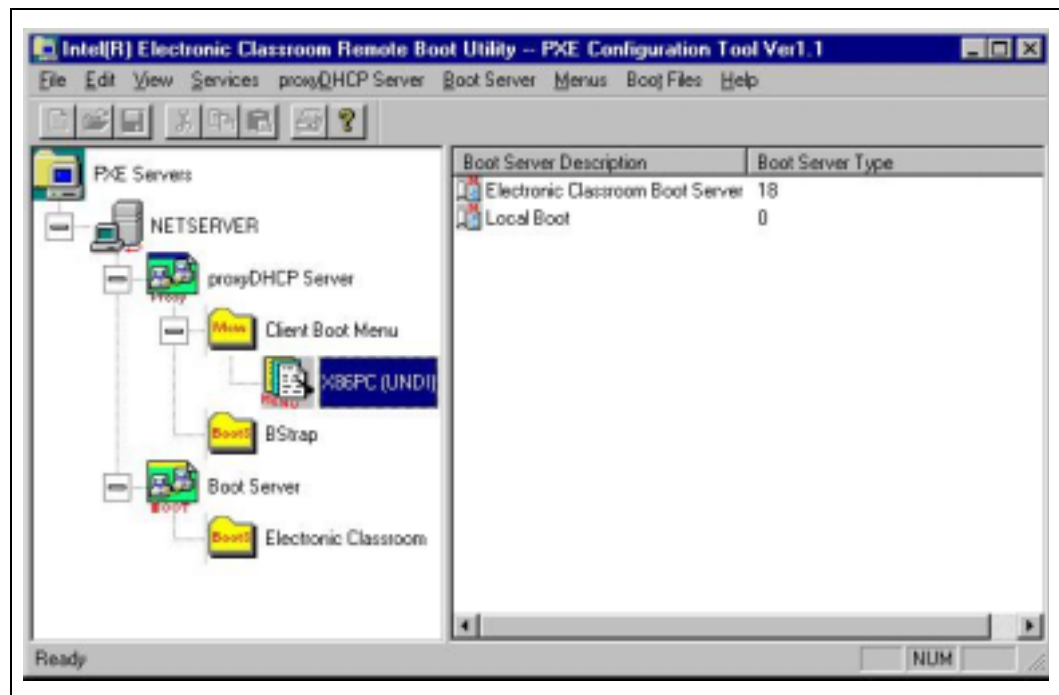
7.1 Default Method

1. Insert the source image floppy into the Floppy disk drive.
2. Start the MKImage.exe from the Start -> Programs -> INTEL Electronic Classroom Remote Boot Utility -> Image Maker.
3. ECRB.1 is generated and stored under:
C:\Program Files\Intel\ECRB\System\images\x86pc\undi\Electronic Classroom directory.

8.0 Configuring proxyDHCP Server and Boot Server

From the Start menu, click on Intel® PXE Configuration Tool (setup -> Programs -> INTEL Electronic Classroom Remote Boot Utility -> Electronic Classroom Remote Boot Utility). The PXE Configuration Tools is displayed as in [Figure 3](#).

Figure 3. PXE Configuration Tool GUI

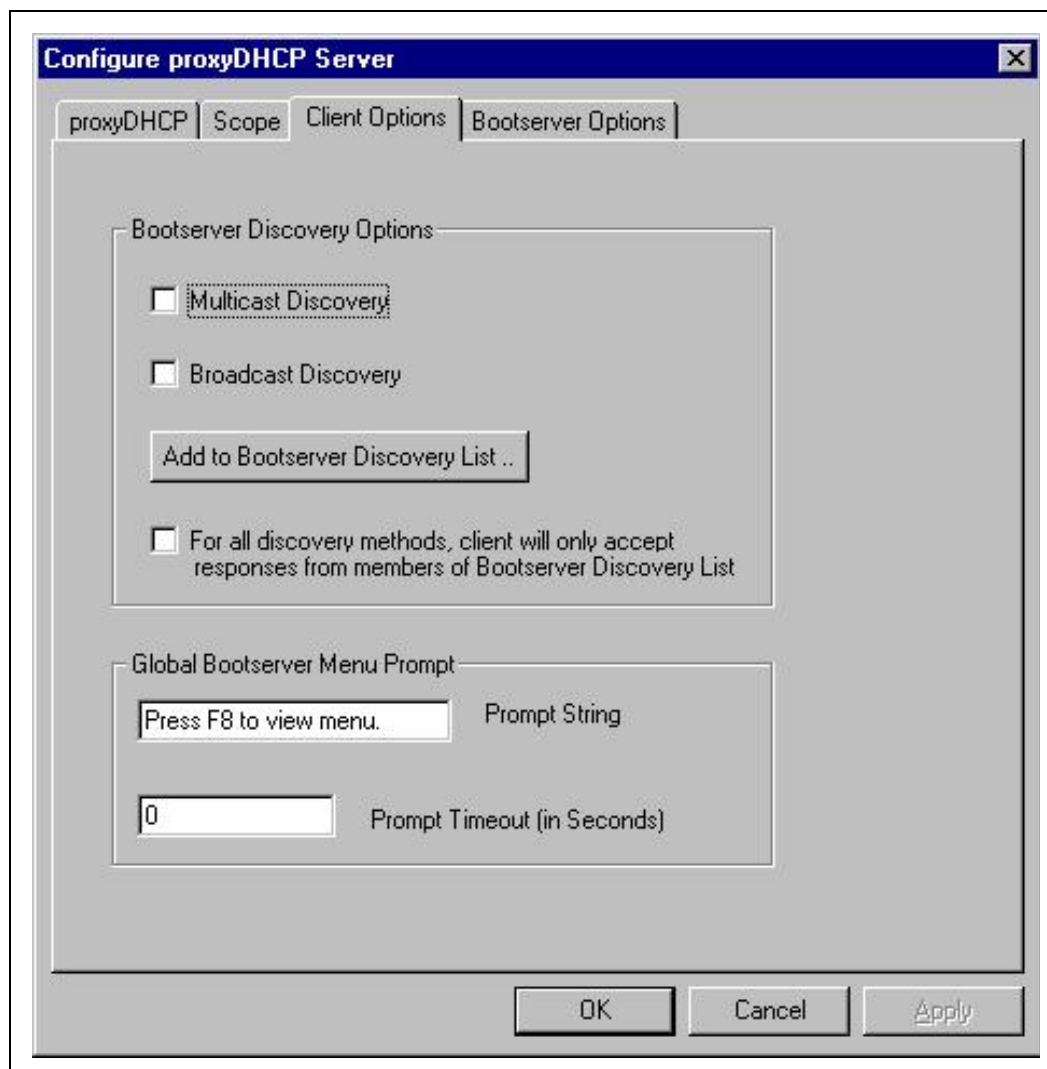


If required, the proxy DHCP Server can be configured as Multicast, Broadcast or Unicast Discovery. The default is Unicast Discovery. Both the Multicast and Broadcast are unchecked. [Figure 4](#) shows Configure proxy DHCP server dialog box.

Below are the steps for configuring the proxy DHCP Server:

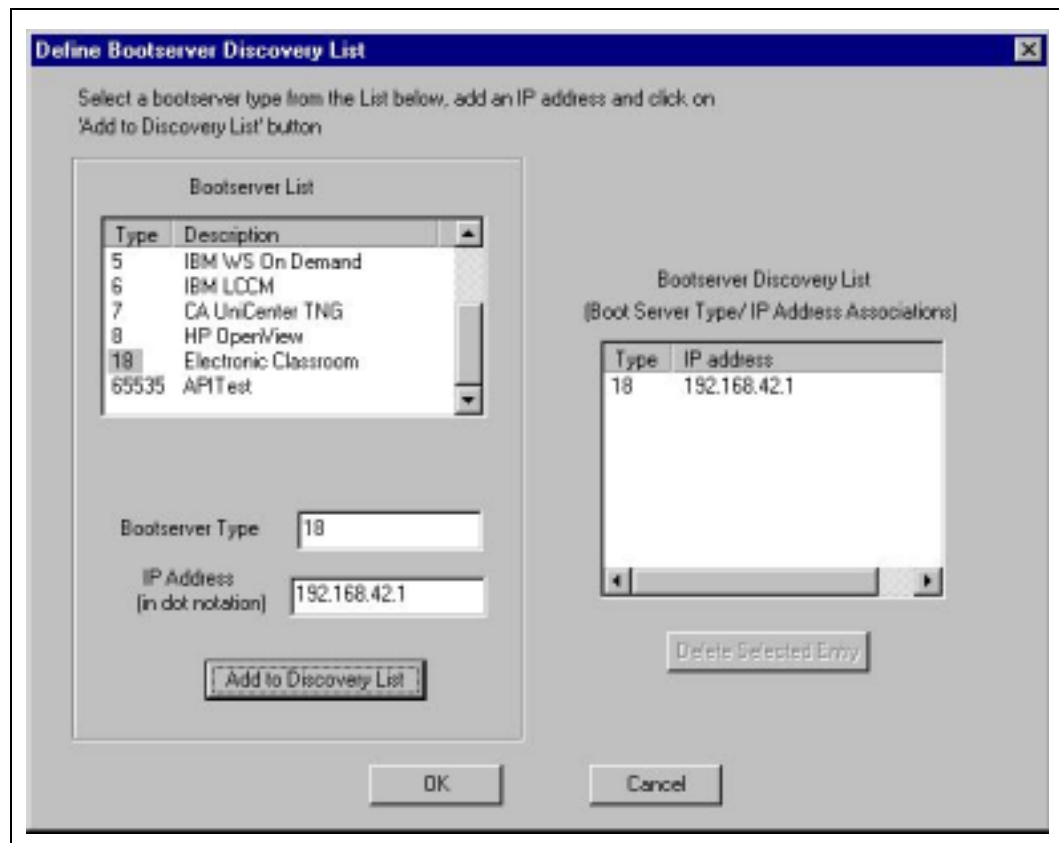
1. Right click the “proxyDHCP Server” icon at the left pane of the PXE Configuration Tool.
2. Select “Configure proxyDHCP Server” and a dialog box of “Configure a proxyDHCP Server” is displayed as in [Figure 4](#).
3. From the “Configure a Proxy DHCP Server” dialog box, select “Client Options” tap and select the Bootserver discovery option as required.

Figure 4. Configure proxyDHCP Server Dialog Box



4. Add Bootserver IP address:
 - a. Click on the “Add to Bootserver Discovery List” button, at the “Configure proxy DHCP Server” dialog box, as shown in [Figure 4](#).
 - b. A Define Bootserver Discovery List dialog box appears.
 - c. Select the boot server type 18 (Electronic Classroom) from the “Bootserver List” and enter your Server IP address in the “IP Address” edit box.
 - d. Ensure that 18 is entered in Bootserver Type edit box.
 - e. Click “Add to Discovery List” button to add the boot server into the “Bootserver Discovery List”.
 - f. Click OK to go back to the main menu (Intel Electronic Classroom Remote Boot Utility) as shown in the [Figure 4](#).

Figure 5. Define Bootserver Discovery List Dialog Box



After the proxy DHCP boot server is configured and assigned an IP address (your server IP) to the boot server, the client is ready to remote-boot its image from the server.

9.0 Summary

Intel provides the building blocks for the electronic classroom to enable the implementation of the Intel-based Electronic Classroom in a short time. The solution is also devised to meet most of the requirements of schools, in particular:

- ease of use
- high uptime
- low maintenance cost requirements

The remote boot service promotes the use of Intel-based Electronic Classroom stations by eliminating the need of a harddisk on each station. The advantages of remote boot are:

- increase network security
- prevent students to introduce viruses
- prevent students accidentally corrupting the operating system and applications
- ease of updating software centrally
- reduce the cost in maintaining system that contain hard disk drives

This implementation guide provides a good jump-start to setup the Intel-based Electronic Classroom.

10.0 Related Information and Web Sites

Table 1 provides the web site locations of additional information relating to Intel-based Electronic Classroom.

Table 1. Web Site Locations for Additional Information

Web Site Description	URL Location
Intel-based Electronic Classrooms website	http://developer.intel.com/platforms/applied/studentstation/index.htm
Intel Main website	http://www.intel.com/
Intel Developer website	http://developer.intel.com/
Intel EIA website	http://developer.intel.com/design/intarch/
Intel-based Electronic Classroom Station Based on the Intel® Celeron™ processor and Intel® 810 Chipset	http://developer.intel.com/design/intarch/applnots/273292.htm
Intel® Wired for Management website	http://developer.intel.com/ial/wfm/index.htm
Network Product	http://www.intel.com/network/
Server Product	http://developer.intel.com/design/servers/

11.0 Questions and Answers

Q. When QUALCNX is launched I get an error stating that IPX or NetBEUI should be installed.

A. This may be related to EMM386. Try uncommenting the EMM386 invocation line in a:\config.sys and see if the error still occurs. If the error disappears and everything runs smoothly, just run this way. Then, if you don't have enough conventional memory to launch Windows*, try to decrease the amount of network buffers. This amount is set by the NETBUFF environment variable, set in c:\winboot\startnet.bat, just before QUALCNX is invoked. The value for this amount of network buffer depends on the NIC and the mother board of the station. Please try the following values that should be working with the corresponding NICs (lower values may work too):

Table 2. Network Buffer Reset

Network Buffers (SET NETBUF=) in Kb	NIC Type
124	RTL8139x (Realtek)
124	Intel® 82559

You may also want to use EMM386.EXE exclusion option (x=aaaa-bbbb). However, you need to know what memory areas should be excluded. Qualsystem may have the required information, so you may just ask for it. If this is done, please provide the complete motherboard and NICs references.

Q. I have trouble with access permissions on files and folders.

A. A problem you may encounter with any system that stores files on network shares, is related to applications not written well, and trying to write files to directories where the user has no write access. This is not due to LiteNET* PC, but to the applications that make assumptions that are not always true, such as "Windows* directory is always accessible in write mode to users". In order to check if a problem you encounter is related to permissions, a simple test can be done: connect with qualcnx with a username and a password that has administrator rights to \\SERVER\SHARE and see if the problem disappears. If it does, then the problem is related to permissions.

In order to resolve such application problems, we provide some techniques and links to tools that may help you. Note that the so-called "not well-written applications" do not work either, this is a Windows* NT environment, where users do not have write permissions to the Windows* directory and where applications stand on network shares, that users do not have write mode access to.

Q. I added read-only protection on all folders, except users folders in the server shared directory, and I have found out that some files may cause problems when fully read protected: pwl (password) files, ini files, some other program folders where programs wrote some files into them.

A. PWL files:

Just add the following lines to c:\Windows*\litenet.reg (on the server side):

```
[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft*\Windows*\CurrentVersion\Policies
```

```
[Network] "DisablePwdCaching"=dword:00000001
```

This disables Windows* password checking mechanism in PWL files.

A. INI files

Windows* tries to write to system.ini or win.ini files, but won't does not complain if those files can not be written.

- Q. Do you recommend protecting C:\Windows* as read only?
- A. Yes. If you do not, then users may change things in the system configuration, viruses can spread all over the system, etc. You should protect every folder, but the users home folders.
- Q. I protected \\SERVER\SHARE as read only and then users can not print jobs from student computing stations.
- A. This is due to Windows* 9x Spooler Directory being write protected on the server side. You can not let this directory be accessible to file creations, because Windows* may use the very same file names for two print jobs (Windows* 9x doesn't make any check on file creation when it creates print jobs).
In order to resolve this problem, you should configure your Windows* 9x system so that print spooling is disabled. To do so, configure every printer in Windows* 9x so that printing is made directly on the printer and not spooled in Windows* 9x spooler. Since you are in a networked environment, your printers should be accessible via the network (as printers shared by some servers or as network printers). So they should already have some spooling mechanism (on the Windows* NT server for instance).
To disable print spooling for a specific printer, do the following:
- Start/Settings/Printers
 - Choose the desired printer and right click on it
 - Choose Property
 - Choose Details tab (the port assigned to the printer should be a network port like \\server\printer1)
 - Click on Spooler Settings
 - Check “Print Directly on Printer”
 - Click OK
- Q. Is there a way to support multiple mother boards and multiple NICs with the very same configuration (that is the very same Windows* directory on the server side and the very same LiteNET* PC bootable floppy disk)?
- A. Heterogeneous hardware is fully supported by Windows* 98. Please refer to LiteNET* PC documentation to know how to install a Windows* 98 system that works in heterogeneous hardware configurations. Please refer to Setting up LiteNET* PC for multiple clients section above.
- Q. When I booted up the student computing station, I saw the message given below:
- PXE-E3B: TFTP error - File not found. (The requested file was not found on the TFTP server.)
- A. Please make sure that you have set the correct IP for the Bootserver using Intel Electronic Classroom Remote Boot Utility (See [Section 8.0](#) for details).
Please reinstall the Windows* NT service pack (version 4.0 and above).
- PXE-E32: TFTP open time out.
- Q. When I booted up the student computing station, the station hangs at the error message stated below, before launching Windows* interface:
- Cannot find or load required file KRNL386.EXE
- A. If you are using Windows* 98 Second Edition at a student computing station, you might have missed the step for running the Ftuner Utility. Please run Ftuner.exe located under LiteNET* PC EZ Installer directory and follow the steps through. You are asked to insert LiteNET* Boot disk into floppy drive for tuning.
If it still cannot work, reinstall LiteNET* PC again.

- Q. When I start to install LiteNET* PC, an error message stating that ECRBService found, but ECRBService.exe is not running or ECRB.exe not found pops up before Step 1.
- A. Provide Administrator rights to Group Memberships of that user under User Manager for Domains and launch ECRB Utility Window at server before proceeding with LiteNET* PC installation. After LiteNET* PC installation, remove Administrator right from Group Memberships of that user.
- Q. When I boot up student computing station, error message specifying username not exist appeared during login process. When I click OK button, the following login prompt showed that username is incorrect, with redundant alphabets appeared.
- A. Reattach your student computing station harddisk, boot up the student computing station, and then go to the Control Panel. Launch Tweak UI and click on Network tab. Uncheck "Log on automatically at system startup". Re-perform LiteNET* PC installation again.

Appendix A Dual-Server Network Interface Controller Load Balancing Implementation

A.1 Overview

As the Intel-based Electronic Classroom is running in a network environment, a crucial point of vulnerability is the network link to the classroom server, where a failure or bottleneck can hamper productivity for many users.

Typically, a classroom server is recommended to serve 50 student computing stations or less. If there is a requirement for a server to serve more than 50 student computing stations, there may be a need for a higher network bandwidth than the 100 Mbps network link.

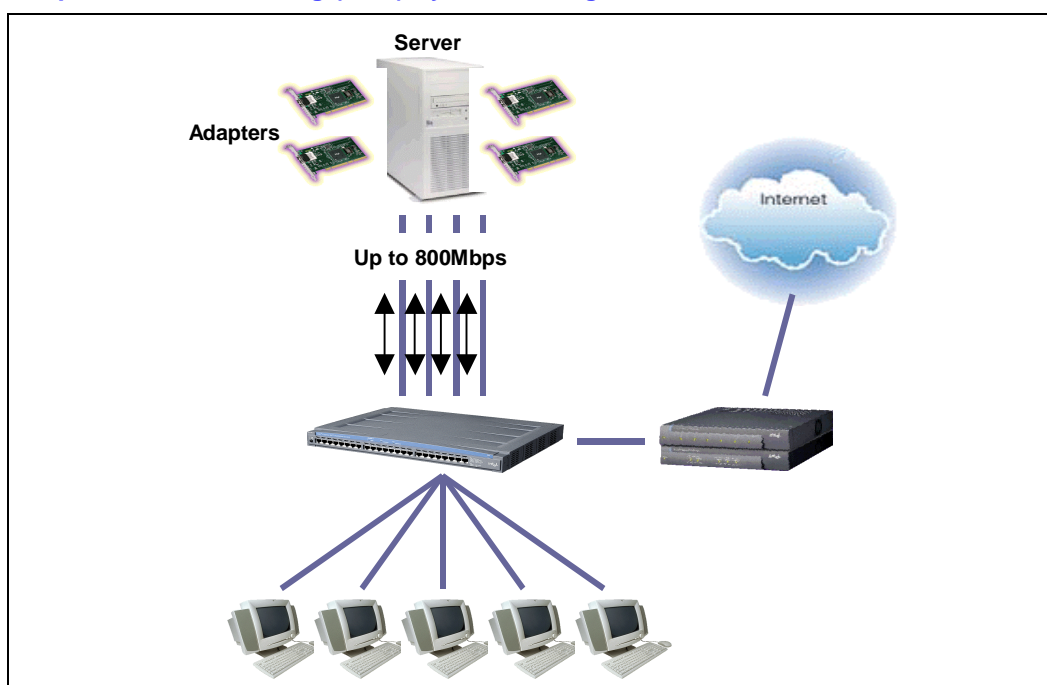
A good way to increase the bandwidth of the network link within the server is to use two or more NICs in the server with the Intel Adaptive Load Balancing technology.

A.2 Adaptive Load Balancing Technology

Intel® Adaptive Load Balancing (ALB), also known as asymmetric port aggregation, is a method of ensuring consistent high server throughput and transparent backup connections by using multiple network interface cards and balancing the data transmissions across them. As many as four Intel server adapters, connected to a switch, can be configured to work together as a “team”. With Intel® 500 Series Switches, that support Link Aggregation, full duplex traffic loads can be handled and the aggregate throughput of up to 800 Mbps with Fast Ethernet adapters or 8 Gbps with Gigabit Ethernet can be achieved.

ALB technology increases throughput by balancing data transmission across multiple adapters. It also delivers fault tolerance capability, because if one link fails, the other NICs continue to assure network connectivity. This method requires no client configuration, and clients do not have to be routed to communicate with each other. Moreover, traffic is balanced among all server adapters. Figure 6 illustrates the ALB approach.

Figure 6. Adaptive Load Balancing (ALB) System Configuration



As many as four Intel server connections can be configured to work together as an Adaptive Load Balancing “team.” All of the adapters in a team must be connected to a switch, and the team is assigned a single network address.

As with Adapter Fault Tolerance, an intelligent, adaptive agent is included with the software driver. To coordinate ALB, this agent dynamically manages the server adapter team and evenly distributes the load among them by constantly analyzing the traffic flow from the server. Thus, all traffic sent from the server is balanced across the server adapters. (One channel within an ALB team carries traffic to and from the server. The others carry traffic from the server only.) This load balancing of server transmissions assures that all users enjoy the same network response from the server.

By taking advantage of Adaptive Load Balancing, a four link configuration can yield an aggregate throughput of approximately 400 Mbps.

A.3 Recommended System Requirements

The following system requirements are recommended to implement the server for Intel-based Electronic Classroom:

- Pentium® III 600 MHz and above
- 128 MB RAM
- CDROM drive
- 10 GB or above HDD

The following NIC hardware type is required for load balancing implementation at server.

- PRO/100 S Server Adapter
- PRO/1000 Gigabit Server Adapter
- PRO/100 Intelligent Server Adapter
- PRO/100+ Server Adapter
- PRO/100+ Dual Port Server Adapter

The server adapter driver will also work if you use the On Board LAN in L440GX+ Server Board.

Up to four adapters can be installed at the server for load balancing implementation.

A.4 Load Balancing Implementation

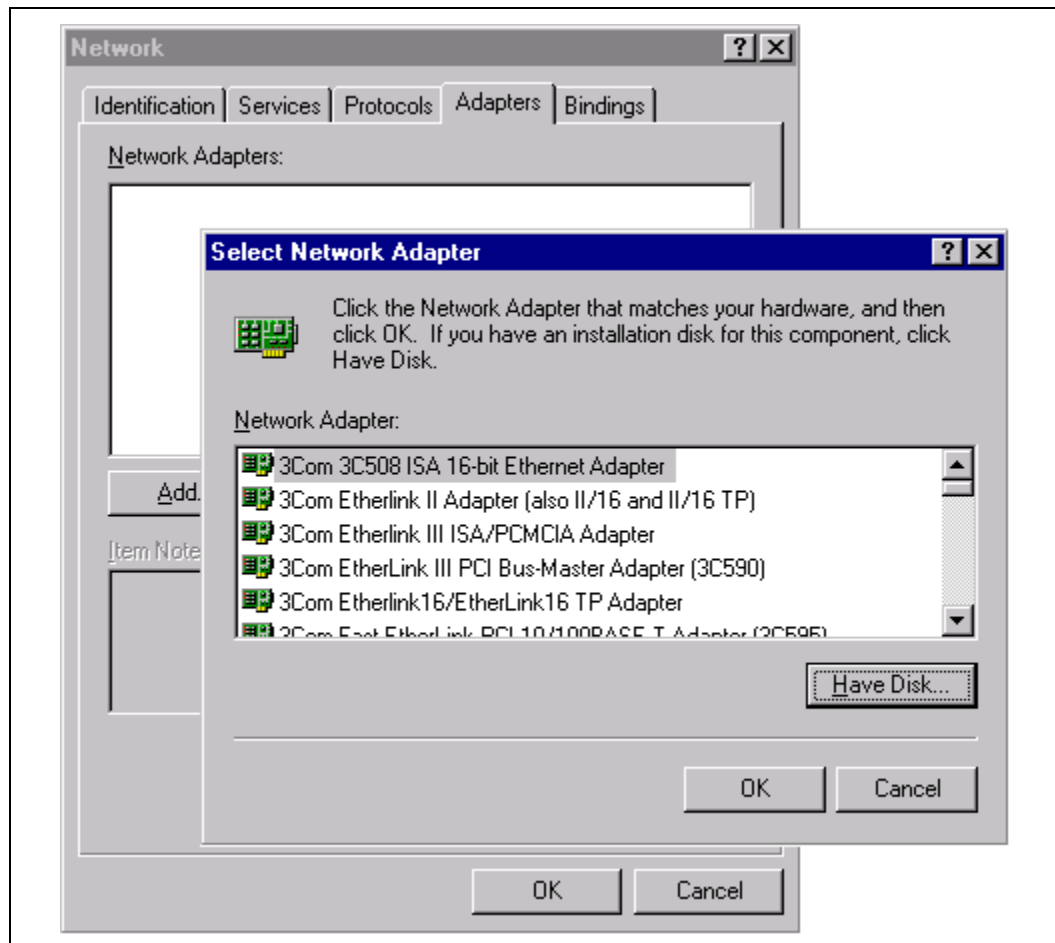
A.4.1 Setting up the Network Drivers

The section describes how to setup network drivers at Windows* NT4.0 servers.

Installation Steps:

1. Install the desired network cards into the server.
2. Go to Network Properties (Select Start -> Settings -> Control Panel -> Network). Select Adapters.

Figure 7. Select Network Adapter Menu

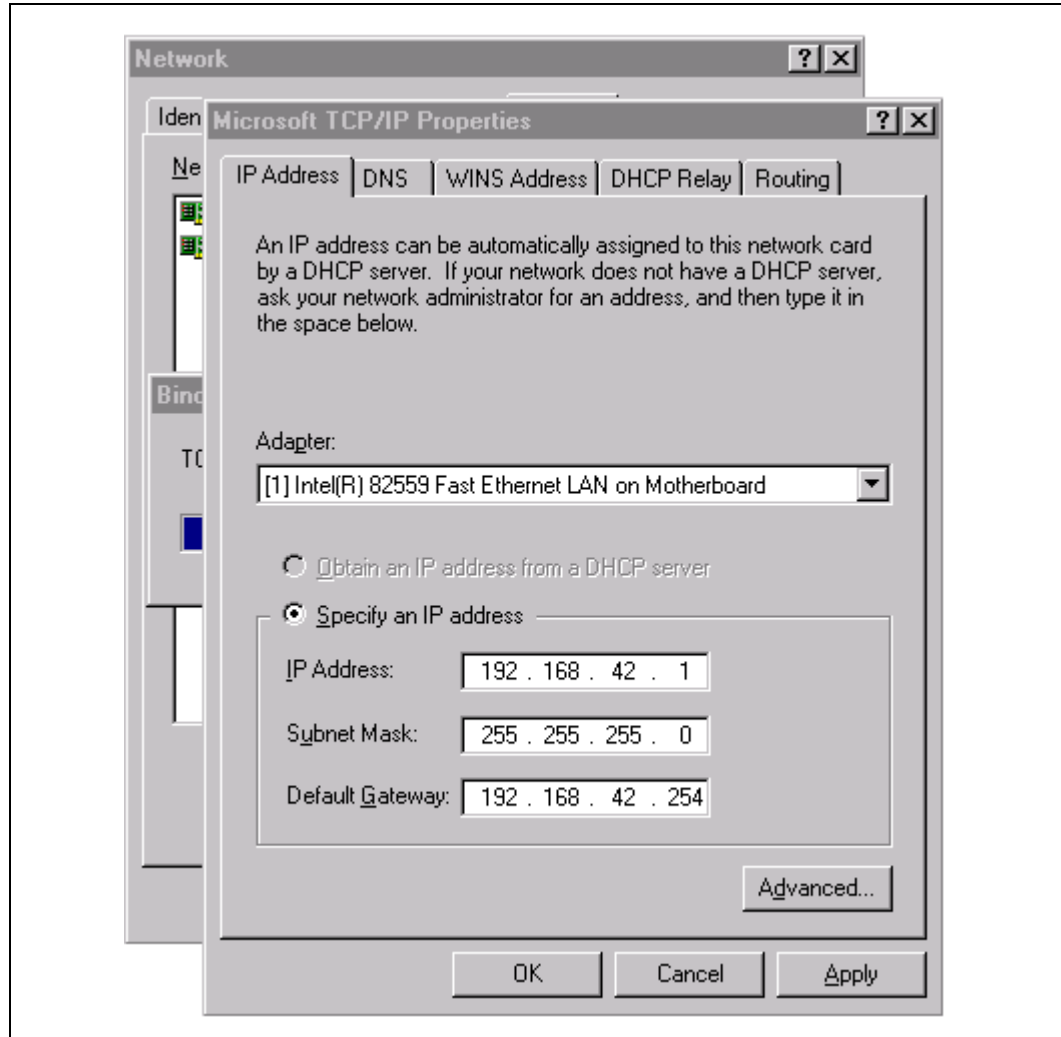


3. Click "Add" to add additional Network Adapters. Select "Have Disk" and point the installation wizard to the location of your Intel Network Adapter Drivers.
4. Select your desired Network Adapter Driver to be installed and click "OK".
5. If you have different Intel Server Adapters, make sure your driver is working for both adapters. If another driver is needed for the second adapter, use "update driver" to install the second driver.

(Network Properties -> Adapters -> Highlight the adapter that you wish to install driver for -> Update -> Select location of your driver)

6. If you have NWLink IPX/SPX protocol installed, a dialogue box pops up to ask you to change the internal network number. Select “No” for not to change the number.
7. Specify your IP address for the Primary and Secondary Adapter. The IP address should be different for the primary and secondary adapter (e.g., 192.168.42.1 and 192.168.42.2).

Figure 8. TCP/IP Properties Menu



8. Reboot your system when prompted.

A.4.2 Teaming the Adapters

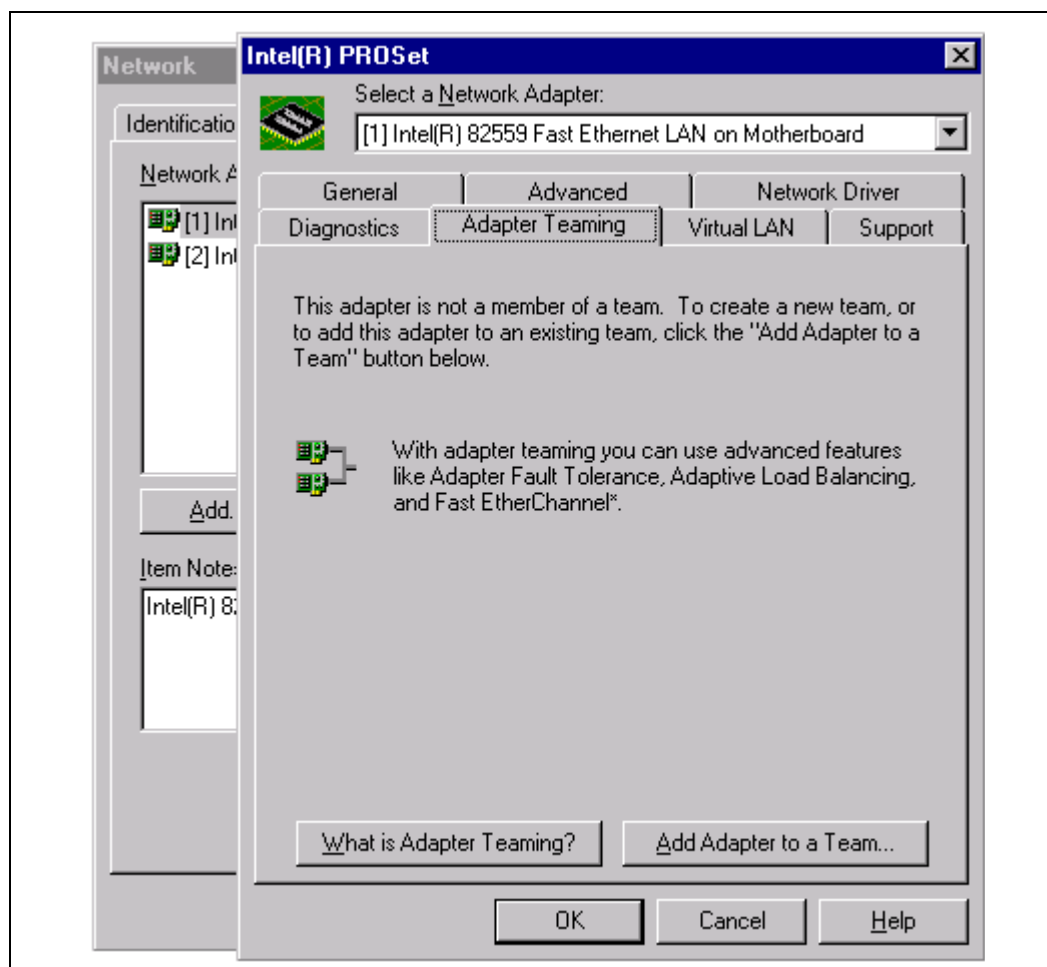
When the drivers are properly installed, you may find your server name in the “Network Neighborhood”.

This section describes how to team the adapters in your server in order to implement load balancing.

Instructions:

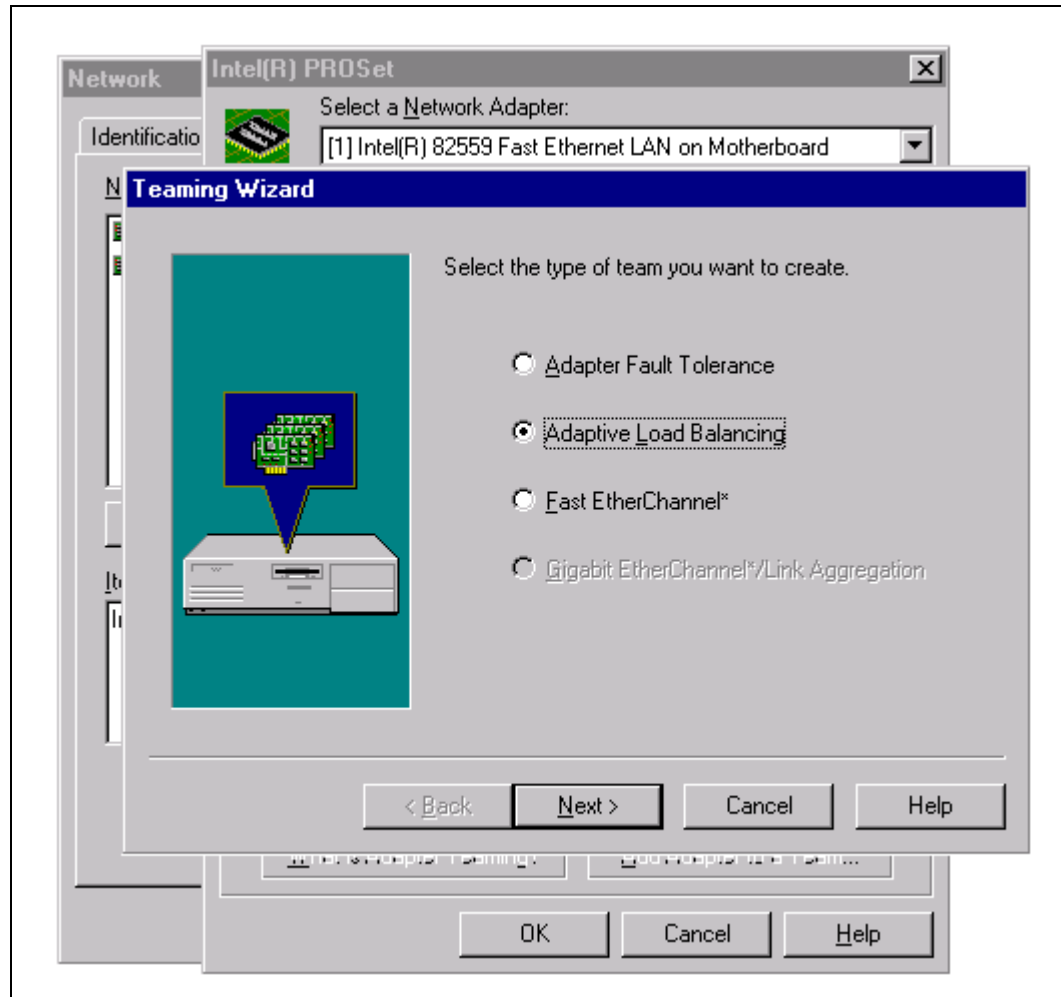
1. Go to “Network Properties”, select adapters, highlight the primary adapter that you wish to assign and click on “Properties”.
2. Select “Adapter Teaming” and click “Add Adapter to a Team”.

Figure 9. Adding a Team Adapter



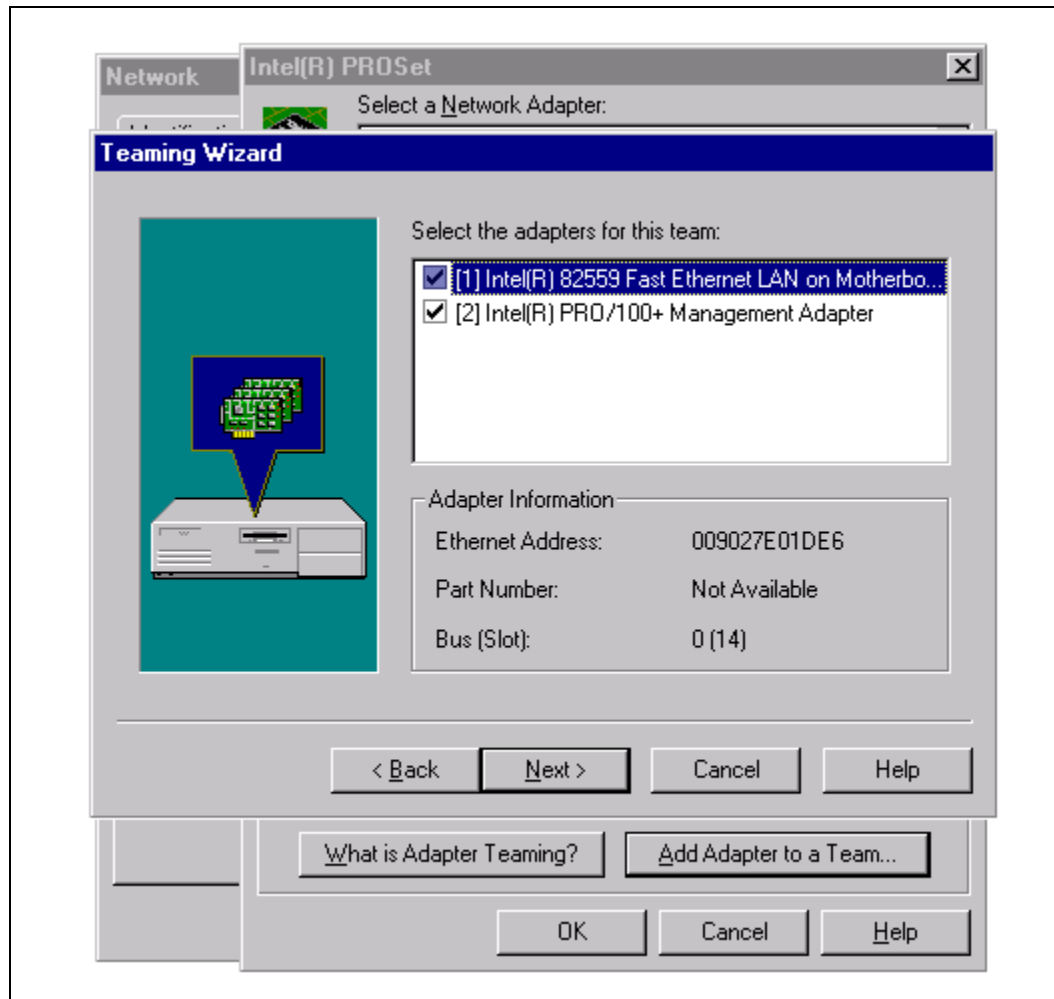
3. At “Team Wizard”, select “Adaptive Load Balancing” and click “Next”.

Figure 10. Adaptive Loading Balancing



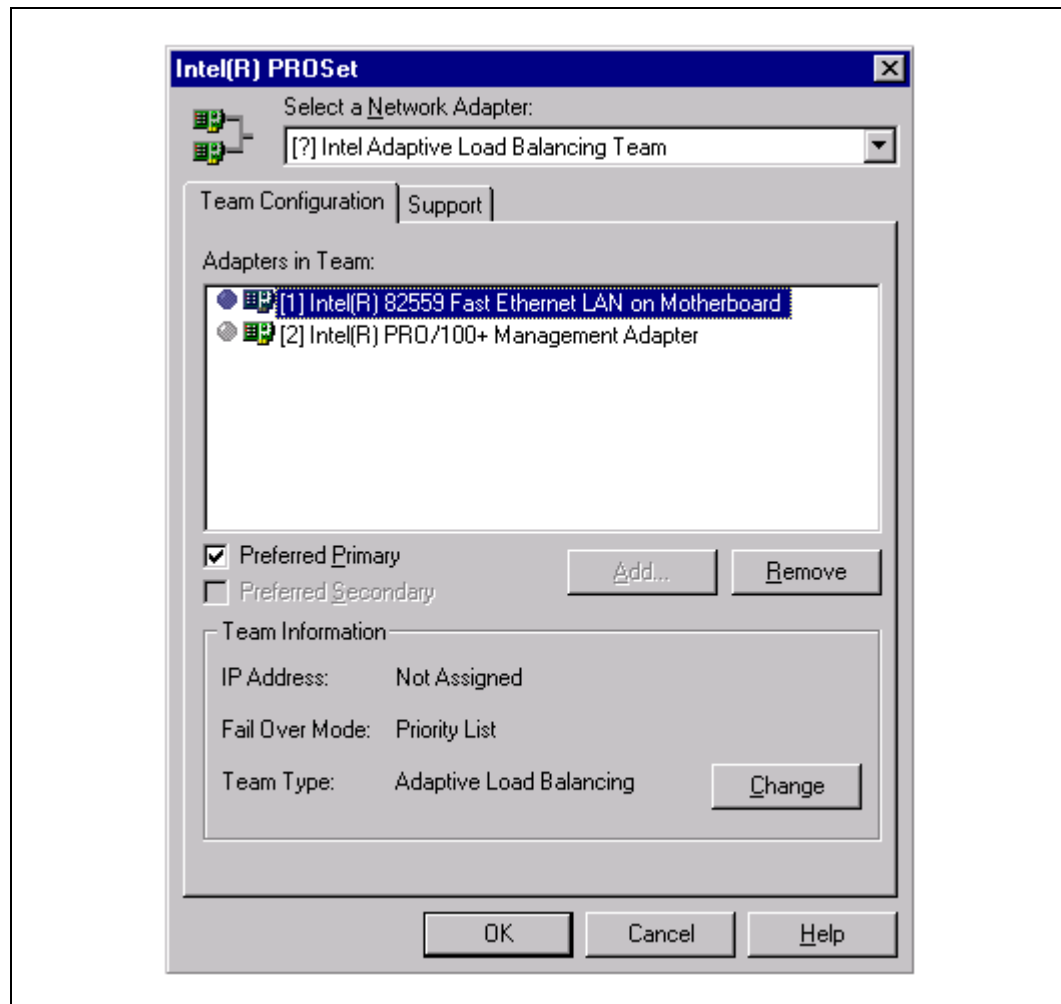
4. Check to select which adapter that you wish to assign together as a team to enable load balancing, click “Next” and “Finish” to apply the changes to Adapter Teaming.

Figure 11. Select Adapters for Load Balance Teaming



5. Now that you are back to the Intel Adaptive Load Balancing Team Properties, highlight the adapter that you wish to assign as the primary adapter and check the “Preferred Primary” box. The system then uses the primary adapter MAC address for all applications.

Figure 12. Assigning Primary Adapter



6. Highlight the other adapter to check the “Preferred Secondary” box. Click “OK” to finish installation.
7. Assign the IP address to the Adaptive Load Balancing Team when prompted. This IP address is different than IP addresses for primary and secondary adapters. This IP address is used as the server IP address and share among all the adapters in the load balancing team.
8. After the configuration and enabling the load balancing feature, the load balancing configuration can be modified by selecting “Advanced” at the Adaptive Load Balancing Team Properties.

A.5 Summary

Load balancing implementation is recommended for Intel-based Electronic Classroom servers that serve more than 50 student computing stations. With Intel Server Adapters, up to four adapters can be installed at the same time to implement load balancing and fault tolerance. The system can therefore achieve up to 400 Mbps Ethernet bandwidth.

Appendix B Intel® InBusiness™ Internet Station Implementation

B.1 Overview

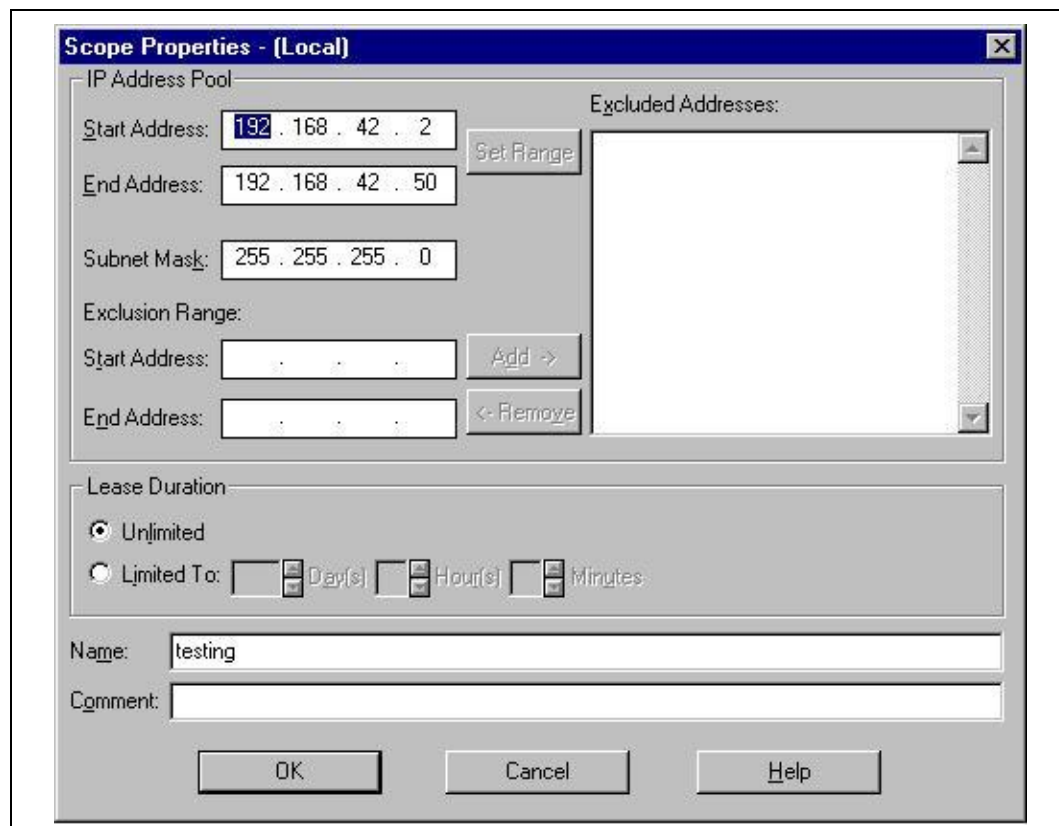
The Intel-based Electronic Classroom solution provides multiple methods and scalability of implementation to establish connection internet. In certain cases when cheaper cost solution is required, the Intel® InBusiness™ Internet Station enables the feature of having all Student Computing Stations, Teacher Station and other PCs connected to LAN possess, the capability to access to the internet via one phone line. Basic configuration required to be done at server and Student Computing Station to enable the feature.

B.2 Intel® InBusiness™ Internet Station Implementation

B.2.3 Configuration at Server (Add 003 Router and 006 DNS Servers Options into DHCP scope)

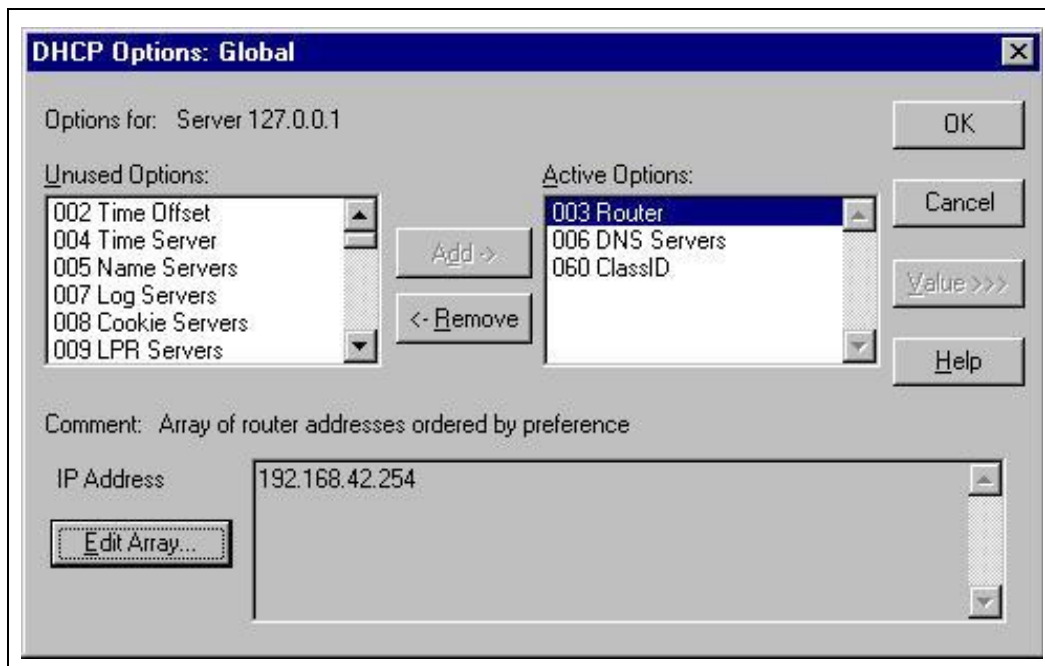
1. Launch “DHCP Manager”. Ensure DHCP scope range falls under 192.168.42.n (n is from 1 to 127). In the “Start Address” and “End Address” boxes, type the beginning and ending IP addresses fall under the stated range.

Figure 13. Modifying Start/End Addresses for DHCP Scope



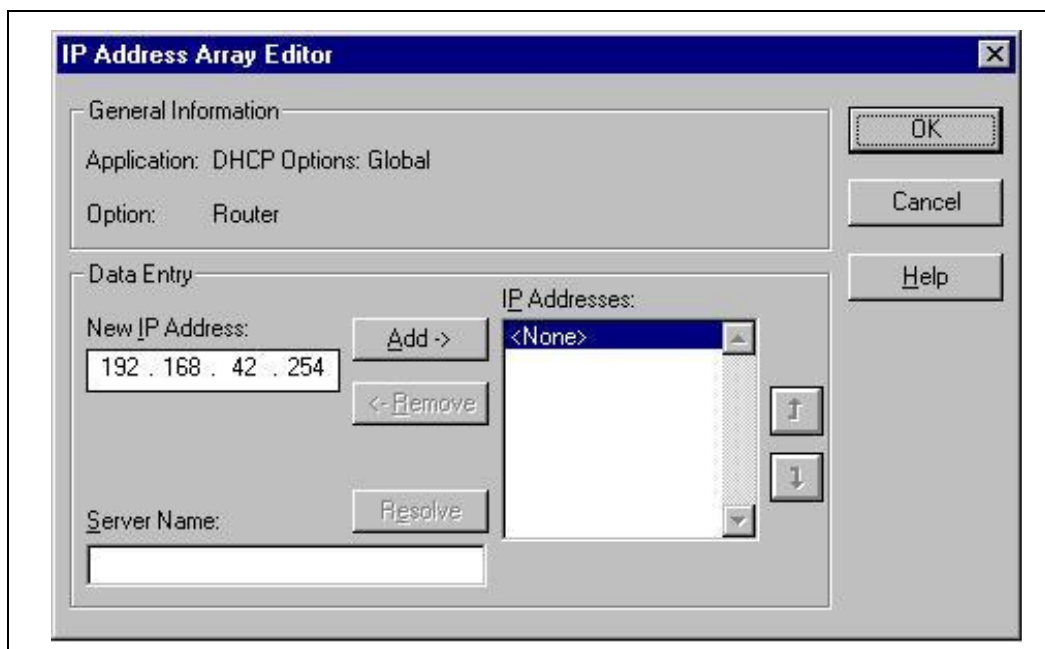
- Highlight the scope and select the menu “DHCP Options -> Global” to display DHCP Options: Global dialog box.

Figure 14. DHCP Options



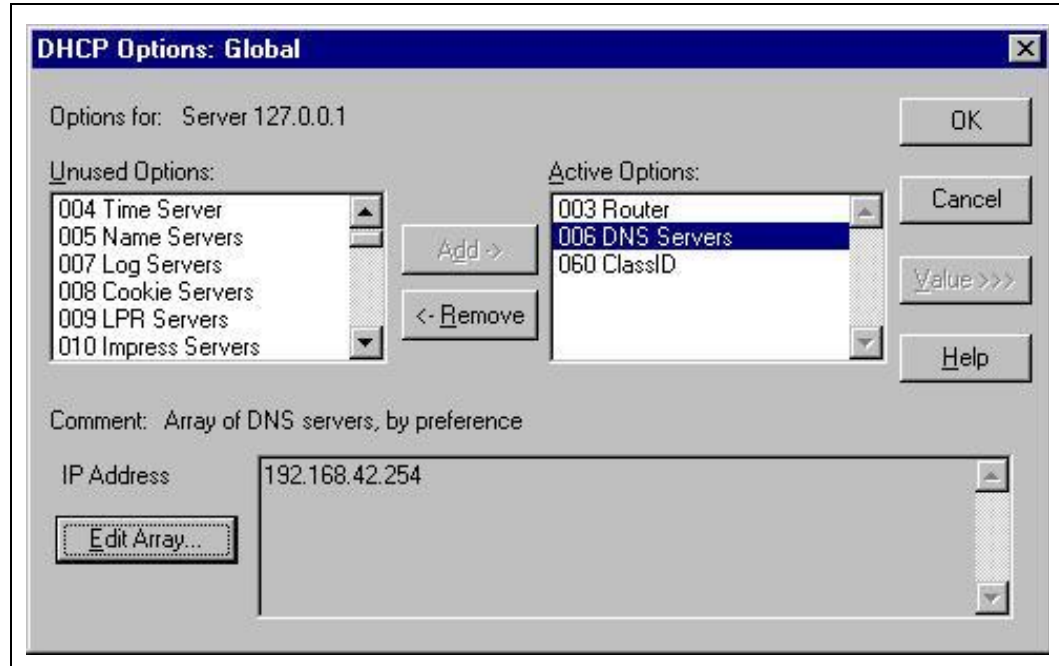
- Select option 003 (Router) and click “Add ->” button, followed by “Value>>>” button.
- Click “Edit Array” button and type “192.168.42.254” into new IP address. Click “Add” button to add the address into the list.

Figure 15. IP Address Array Editor



5. Click “OK”.
6. Select option 006 (DNS Servers) and click “Value>>>” button.

Figure 16. Selecting DHCP Options

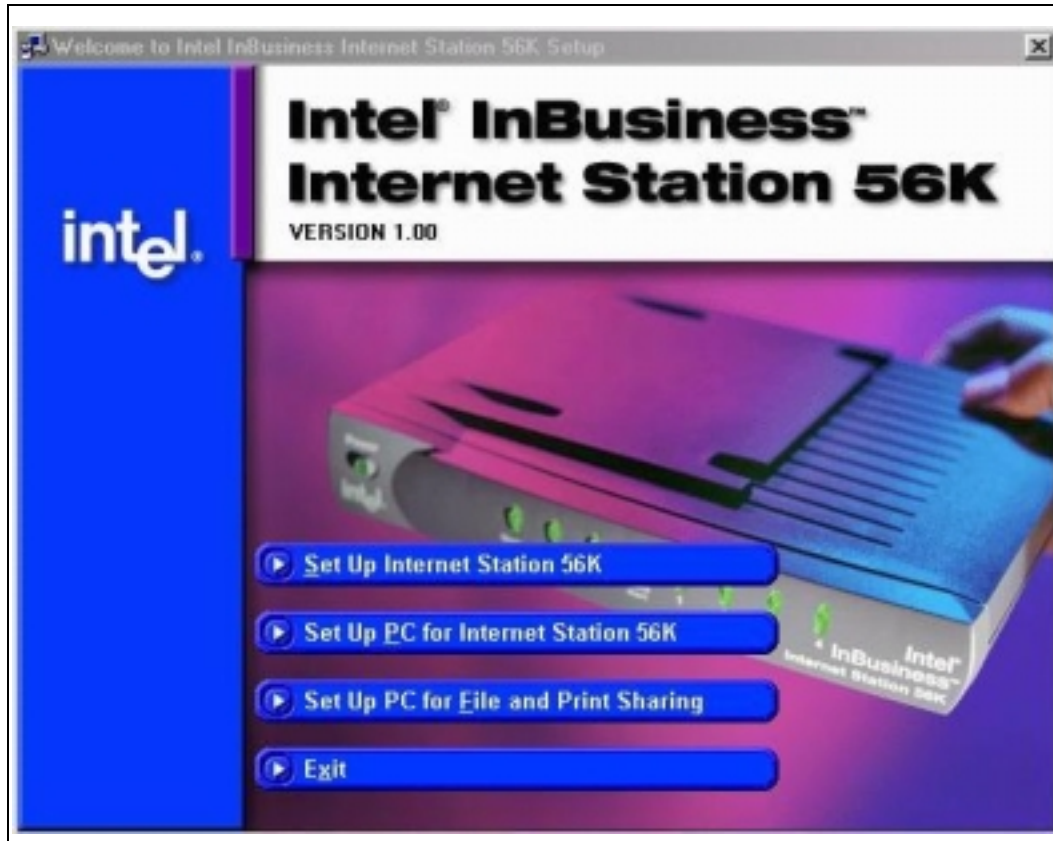


7. Perform Step 4 and 5.
8. Restart all student computing stations to ensure the changes effective.
9. The rest procedures are the same as normal Intel-based Electronic Classroom Implementation Guide.

B.2.4 Configuration at Student Computing Station

1. Run Setup.exe from Intel® InBusiness™ Internet Station installation CD before performing LiteNET* copy from local hard disk to server.

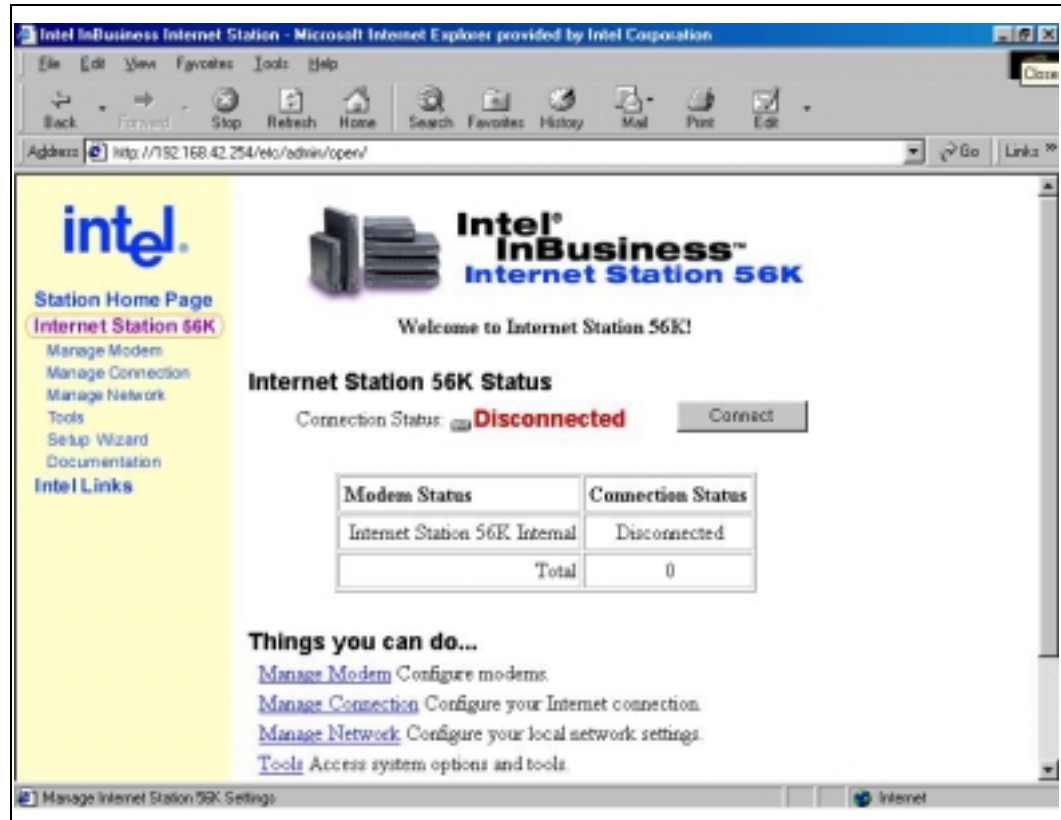
Figure 17. Intel® InBusiness™ Internet Station 56K Setup Menu



2. Click first option "Set Up Internet Station 56K".
3. Follow through the procedures to set up internet station. Install Internet Explorer 5.0 if needed as instructed by the installation procedures. The Intel® InBusiness™ Internet Station web page is launched upon completion. Icon is added at the bottom right of the screen on toolbar.

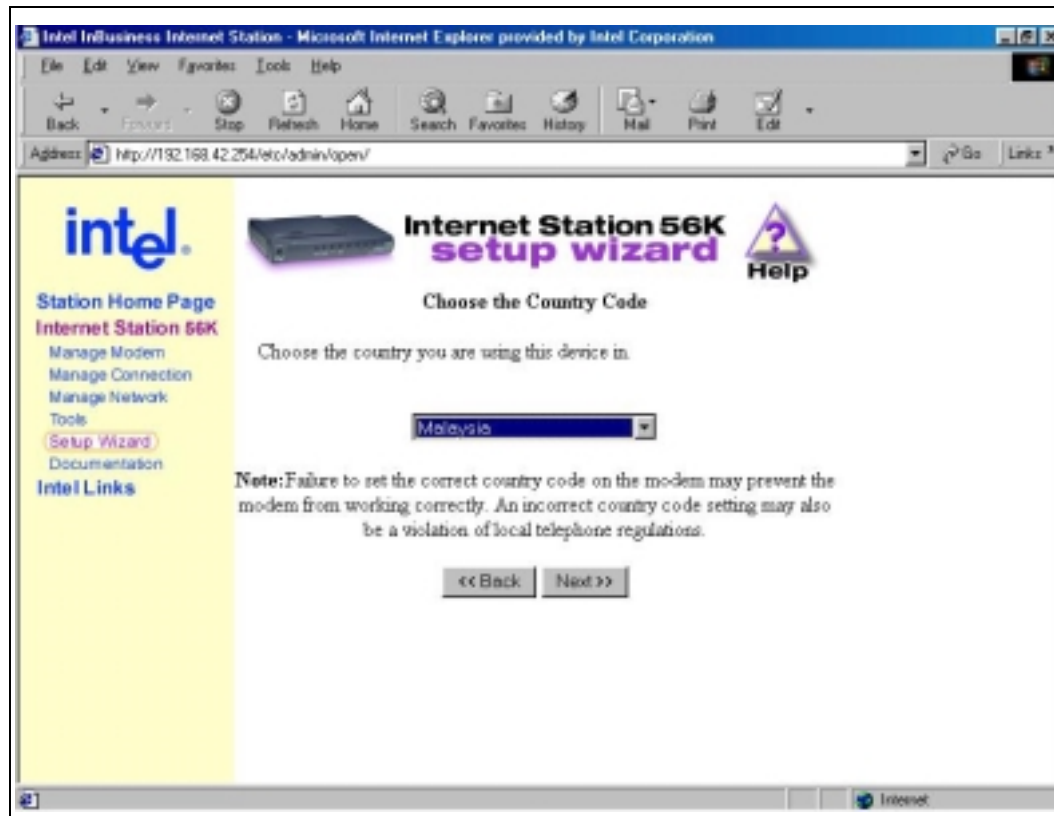
4. Upon launching the web page for the internet station, click “Internet Station 56K” from the left column of the web page.

Figure 18. Intel® InBusiness™ Internet Station 56K Home Page



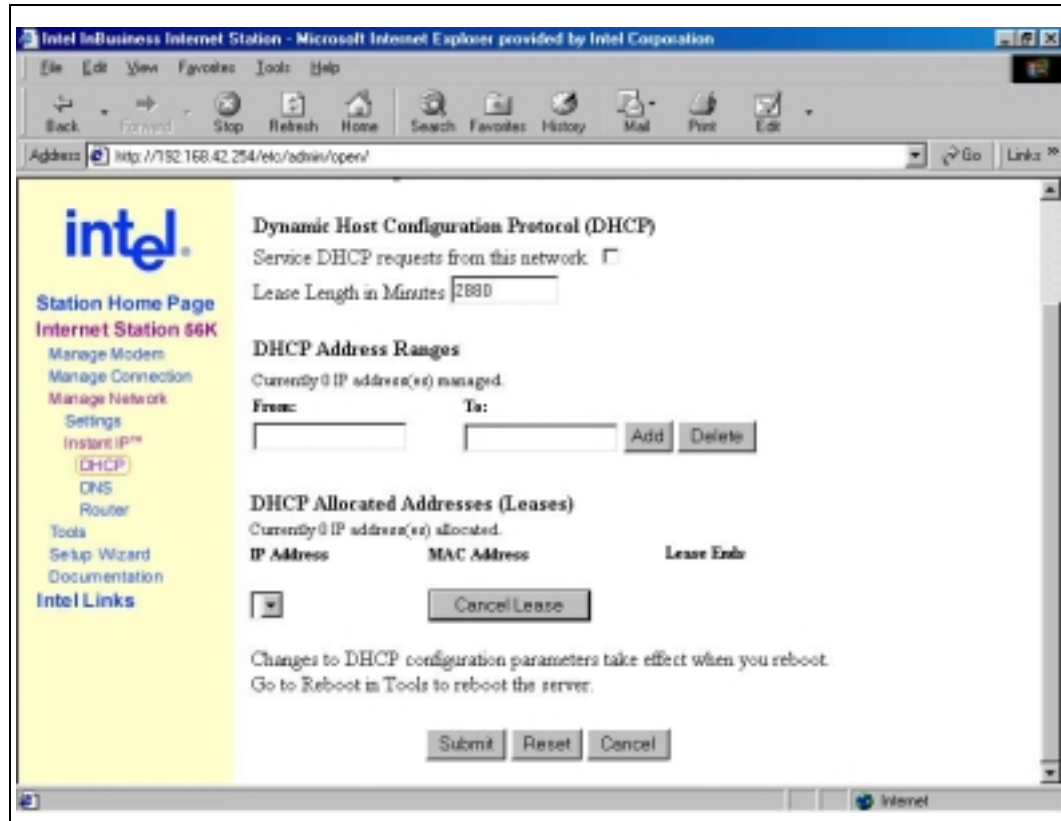
5. Click “Setup Wizard” inside the web page to configure your internet station with ISP information, dial-in country, etc., included by following the steps provided.

Figure 19. Intel® InBusiness™ Internet Station 56K Setup Wizard



6. Go to Intel® InBusiness™ Internet Station web page and click “Internet Station 56K -> Manage Network -> Instant IP -> DHCP” to disable/untick DHCP function. Click “Submit” button upon completion.

Figure 20. DHCP Menu



Intel InBusiness Internet Station - Microsoft Internet Explorer provided by Intel Corporation

Address: http://192.168.42.254/elo/admin/open/

Station Home Page
Internet Station 56K
 Manage Modem
 Manage Connection
 Manage Network
 Settings
 Instant IP™
DHCP
 DNS
 Router
 Tools
 Setup Wizard
 Documentation
 Intel Links

Dynamic Host Configuration Protocol (DHCP)
 Service DHCP requests from this network: ☐
 Lease Length in Minutes: 2880

DHCP Address Ranges
 Currently 0 IP address(es) managed.
 From: To: Add Delete

DHCP Allocated Addresses (Leases)
 Currently 0 IP address(es) allocated.

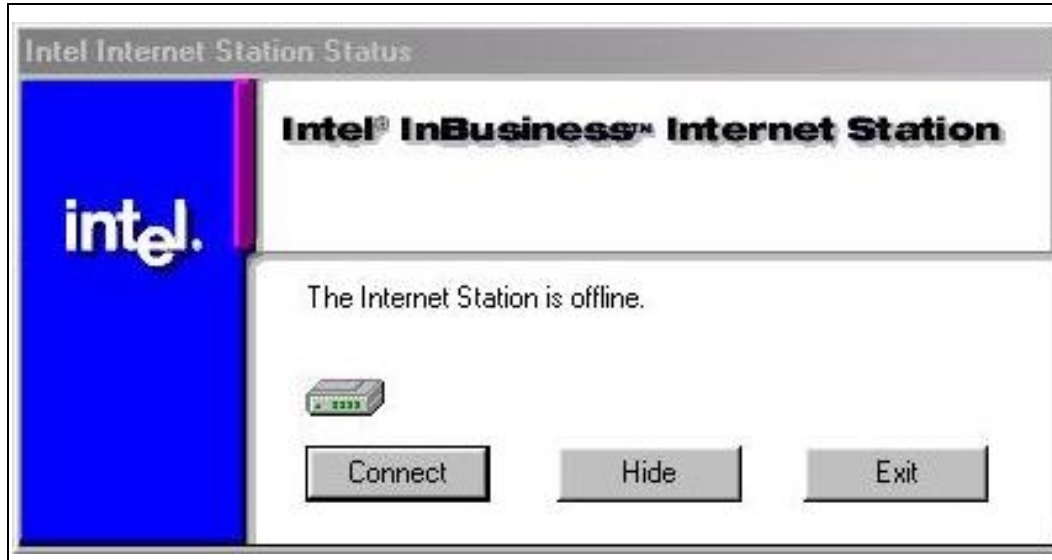
IP Address	MAC Address	Lease Ends
Cancel Lease		

Changes to DHCP configuration parameters take effect when you reboot.
 Go to Reboot in Tools to reboot the server.

Submit Reset Cancel

7. Click “Connect” button on web page or icon at the bottom right corner to connect to internet.

Figure 21. Intel® InBusiness™ Internet Station Status Menu



8. To setup other PCs for using internet station, ensure PCs are connected to Internet station and run Setup.exe from Intel® InBusiness™ Internet Station installation CD. Click second option “Set Up PC for Internet Station 56K” and follow the setup procedures.

B.2.5 Important Notes

1. Refer to “Quick Setup Guide - Intel® InBusiness™ Internet Station 56K” manual for more detail setup guide. The manual comes together with purchase of internet station.
2. If the internet station is found to be misconfigured (modem disabled, malfunction, etc.), it can be restored to normal functionality by clicking “Reset to Factory Setting” on the web page and by following the setup procedures through again. Ensure DHCP function for internet station is disabled as stated under Note (v).
3. The web page of Intel® InBusiness™ Internet Station (which is the flash content inside the internet station) can be viewed by typing 192.168.42.254 inside the address field of the internet browser and then click ENTER.
4. Installation of internet station cannot be done under diskless condition (after LiteNET* process). It must be done before LiteNET* process.
5. The DHCP function of internet station under “Internet Station 56K -> Manage Network -> Instant IP -> DHCP” needs to be disabled to avoid IP conflict issues at the student computing station, with the DHCP function at the server side being activated.

B.3 Summary

Implementation of Intel® InBusiness™ Internet Station into Intel-based Electronic Classroom solution, provides feasibility for school to setup internet access through cheaper cost and easier configuration. Even though multiple access through one phone line at the same time slows down internet access time, as the maximum speed is only 56K at one time, the internet station implementation still provides a good facility to a school, to enable the internet-based teaching environment, while applied together with others multimedia teaching software.

Appendix C Multi-Servers Implementation

C.1 Overview

This document is meant to help the System Integrator (SI) in setting up multiple Intel-based Electronic Classrooms with multiple servers that are networked together. Introducing multiple servers in LAN helps to balance the single-server load.

This document assumes that you are familiar with Windows* Networking and that you know:

- How to setup a single-domain electronic classroom based on Intel-based Electronic Classroom Solution.
- The functions or role of NT Server as the primary controller, standalone or backup server.
- The DHCP server to manage clients from different domains.

C.2 Implementation Types

1. Multiple Primary Domain Controllers implementation into Intel-based Electronic Classrooms.
2. Single Primary Domain Controllers with multiple standalone servers.

C.3 Multiple Primary Domain Controllers

Two or more Primary Domain Controllers can be connected into same LAN to support two Intel-based Electronic Classrooms. The network number of these two servers must be the same, but different host number, so that the two servers can talk to each other without the need of routers.

The Intel-based Electronic Classroom clients can be booted up to any of the servers randomly. Thus, both server 'shared drives content' must be the same, to support the client boot up.

1. Setup the two NT Server separately according to the steps describe in [Section 2.0](#) (name one server as 1st server and the other one as 2nd server).
2. Add-in users for clients (student computing station) using "Domain Users Manager" tool from pull-down menu of "Administration Tool" from START taskbar. (Do same for both servers).
3. Install Intel Electronic Classroom Remote Boot Utility according to the steps as describe in [Section 3.0](#), at both servers.
4. Install LiteNET* PC for student computing station to copy harddisk content to the 1st server.
5. Make image file from LiteNET* PC bootable disk, Using Intel Electronic Classroom Remote Boot Utility at 1st server.
6. Create a shared directory into a 2nd server (different shared name from that used in 1st server).
7. Copy the client harddisk content from the 1st server to the 2nd server.
8. Create a shared directory for each client, at each server (the shared names must be different at each server for each client).
9. Edit the setvars.bat file in the LiteNET* bootable disk, to point the BIOS shared drive to the shared drive name, that you had shared out from the 2nd server. Save the file.
10. Create the image from the LiteNET* bootable disk that you just modified using ECRB Utility.

11. Repeat step 6 to 10 if you have other PDC to be networked to the LAN after you have setup individual NT server.
12. Boot-up all the clients to ensure all the clients can enter the remote boot environment. (Note: the clients can boot-up from either one of the two or more servers, depending on the DHCP OFFER selected by the clients).

Note: The computer name inside the Netnames.db file, that resides in both servers, must be different according to the username defined for each Primary Domain Controller.

C.3.1 Single Primary Controller with Multiple Standalone Server

1. Install a server with NT Primary Controller (PDC).
2. Add all the usernames for the clients in the LAN.
3. Install DHCP Server into the NT Primary Controller (Do not install ECRB Utilities into PDC).
4. Setup the individual standalone servers with ECRB Utilities.
5. Make sure all the necessary protocols: IPX/SPX Compatible protocol and TCP/IP Protocol, are available in each server (PDC and standalone servers).
6. Install LiteNET* PC for the student computing station, to copy the harddisk content to the 1st standalone server.
7. Make image file from LiteNET* PC bootable disk, Using Intel Electronic Classroom Remote Boot Utility at 1st standalone server.
8. Create a shared directory into a 2nd standalone server (different shared name as named in 1st server).
9. Copy the client harddisk content from the 1st standalone server to the 2nd server.
10. Create a shared directory for each client at each server (the shared names must be different at each server for each client).
11. Edit the setvars.bat file in the LiteNET* bootable disk, to point the BIOS shared drive to the shared drive name, that you had shared out from the 2nd server. Save the file.
12. Create the image from the LiteNET* bootable disk that you just modified using ECRB Utility.
13. Repeat step 8 to 10 if you have another standalone server to be networked to the LAN, after you have install and setup the NT server.
14. Boot-up all the clients to ensure all the clients can enter the remote boot environment. (Note: the clients can boot-up from either one of the two or more servers, depending on the DHCP OFFER selected by the clients).

Note: All the clients (student computing stations in the LAN must be identical) and the PDC role are just for domain user management.

C.4 Summary

Multi-server connections provide scalability, of extending the Intel-based Electronic Classroom solution, by linking multiple Intel-based Electronic Classrooms together. The interactivity and connectivity are not limited to one classroom anymore.

Appendix D Intel-Based Electronic Classroom Equipment Setup Checklist

Table 3. Server Checklist

Equipment	Item	Amount	Check (3/ 5)
Server	Pentium® III processor 600 MHz or above	1 Unit	
	Intel® L440GX+ / Intel® T440BX Motherboard	1 Unit	
	Standard Video Card	1 Unit	
	Intel® 82559 based 100Mbps LAN adapter (Supports PXE BIOS Boot Strap)	1 Unit	
	15 GB or more IDE / SCSI Hard Disk Drive	1 Unit	
	Standard CDROM Drive	1 Unit	
	Standard Floppy Disk Drive	1 Unit	
	Standard ATX Power Supply, Chassis and Power Cord	1 Unit	
	SVGA Monitor or Digital Flat Panel	1 Unit	
	Direct Power Cord for Monitor	1 Unit	
	PS/2 Mouse	1 Unit	
	PS/2 Keyboard	1 Unit	
	Ethernet Cable (10 feet)	1 Unit	

Table 4. Teacher Station Checklist

Equipment	Item	Amount	Check (3/ 5)
Teacher Station	Pentium® III processor 500 MHZ or above	1 Unit	
	Intel® 440BX/820/810E Chipset Based Motherboard	1 Unit	
	Standard Video Card / Integrated Video Adapter	1 Unit	
	Intel® 82559 based 100Mbps LAN adapter (Supports PXE BIOS Boot Strap)	1 Unit	
	Standard Sound Card / Integrated Sound Controller	1 Unit	
	8 GB or more IDE Hard Disk Drive	1 Unit	
	Standard CDROM Drive	1 Unit	
	Standard Floppy Disk Drive	1 Unit	
	Standard ATX Power Supply, Chassis and Power Cord	1 Unit	
	SVGA Monitor or Digital Flat Panel	1 Unit	
	Direct Power Cord for Monitor	1 Unit	
	PS/2 Mouse	1 Unit	
	PS/2 Keyboard	1 Unit	
	Headset with Microphone (Speaker set optional)	1 Unit	
	Ethernet Cable (10 feet)	1 Unit	

Table 5. Student Station Checklist

Equipment	Item	Amount	Check (3/ 5)
Student Station	Pentium® III or Celeron™ processor 433 MHz or above	1 Unit	
	Recommended Third Party Intel® 810 Chipset Based Motherboards and Chassis	1 Unit	
	Integrated Video Adapter	1 Unit	
	Integrated Sound Controller	1 Unit	
	On Board 100Mbps LAN adapter (Supports PXE BIOS Boot Strap)	1 Unit	
	Standard CDROM Drive (Optional)	1 Unit	
	Standard Floppy Disk Drive	1 Unit	
	SVGA Monitor or Digital Flat Panel	1 Unit	
	Direct Power Cord for Monitor	1 Unit	
	PS/2 Mouse	1 Unit	
	PS/2 Keyboard	1 Unit	
	Headset with Microphone	1 Unit	
	Ethernet Cable (10 feet)	1 Unit	

Table 6. Network Infrastructure Checklist

Equipment	Item	Amount	Check (3/ 5)
Network Infrastructure	Intel® Express 330T Stackable Hub (100 Mbps) or Intel® Express 510T Switch (100 Mbps)	1 Unit	

Table 7. Software Checklist

Equipment	Software	Check (3/ 5)
Server	Microsoft* Windows* NT Server 4.0	
	Windows* NT4 Drivers for Video, LAN, SCSI Devices	
	Intel Electronic Classroom Remote Boot Utility	
Teacher Station	Microsoft* Windows* 98 Second Edition	
	Windows* 98 Drivers for Video, LAN, Sound Devices	
	Multimedia Interactive Learning Software	
Student Station	Microsoft* Windows* 98 Second Edition	
	Windows* 98 Drivers for Video, LAN, Sound Devices	
	Qualystem LiteNET* PC Electronic Classroom Edition	

Table 8. Options Checklist

Equipment	Item	Amount	Check (3/ 5)
Internet Capability	Intel® InBusiness™ Internet Station 56K	1 Unit	
USB Microscope	Intel® Play™ QX3* Computer Microscope	1 Unit	
Video Conferencing	Intel® Create & Share™ camera pack	2 Units	

